Bronze beauty
University research helps growth of sorghum around the world

Producing better produce
K-State improving the quality and shelf life of fruits and vegetables

The sounds of STEAM
Hear the concert of creativity in science, technology, engineering, art and mathematics
A look at Fusobacterium necrophorum in a petri dish. The bacterium causes infections in livestock and people, but researchers at Kansas State University have patented a way to protect animals and humans from Fusobacterium necrophorum infections. Find out more about the university’s latest patents on page 38.
Kansas State University researchers have worked to improve people’s lives since 1863. The best thing about producing our university’s flagship magazine is taking time to review some of our recent accomplishments and ongoing projects that do just that — it’s the mission of our land-grant university; it’s our mission to Seek.

Kansas is renowned for its wheat production, but we’re also the No. 1 sorghum-producing state in the country. Sorghum is an increasingly important crop worldwide. Ongoing work at K-State to fight pests such as sugarcane aphids, to develop genetic tools that breeders use to create new varieties, and to provide products that boost nutrition for children in Tanzania solidify our role as a global food systems leader.

Feeding the world’s growing population requires more than growing the crops. Development of modified atmosphere packaging to extend the shelf life of food products is another example of how K-State helps enhance food security. This work demonstrates our creativity in attacking this multifaceted problem.

Speaking of creativity, our multisensory, interactive story on the sounds of K-State research will make you think of research in a new way. You will hear laser-induced thunder, a concrete compression test, a music composition and more — and you’ll find out about projects from exercise on Mars to prairie burning. Other creative activities on display in these pages include an exploration of how the K-State drama therapy program — one of only five in the country — helps children on the autism spectrum form social connections and learn to work together by engaging them in after-school and summer drama activities. The College of Education is also producing an outstanding series of documentaries, one of which we spotlight here. Teachers in Kansas classrooms are using “Dawn of Day: Stories from the Underground Railroad” to encourage kids to learn more about the history in their own backyards.

Our backyard companion animals are another area of strength at K-State. Researchers in our College of Veterinary Medicine are producing knowledge that benefits both animal and human health. Our people are investigating whether discoveries about the communication barriers in human breast cancer cells apply to canine cancer cells, they are conducting clinical trials of treatments for dogs with a type of bone cancer that is also common in humans, and they are using stem cells to decrease dogs’ pain from hip dysplasia, which may lead to treatments for human osteoarthritis.

This summary is far from complete. Our fall issue has much to offer, so please take a few minutes to “See” (and hear!) how “K”-State research, scholarly, and creative activities and discoveries are affecting our world. I promise you’ll be impressed.

Peter K. Dorhout, Vice President for Research

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Seek is online at Kansas State University’s New Prairie Press, http://newprairiepress.org/
DOE’s nearly $8M grant renewal keeps J.R. MacDonald Laboratory a leader in ultrafast laser research

The “bread-and-butter” physics research at Kansas State University’s J.R. MacDonald Laboratory has received a three-year grant renewal award from the Department of Energy.

The nearly $8 million grant, for “Structure and Dynamics of Atoms, Ions, Molecules and Surfaces,” helps to support laboratory personnel and to maintain and operate the laboratory’s three main ultrafast lasers, known as HITS, KLS and PULSAR. The J.R. MacDonald Laboratory hosts the atomic, molecular and optical physics program in the physics department and is one of the largest such programs in the country. The laboratory involves 69 researchers, including 11 faculty members, three research faculty, six staff members, 27 graduate students, 25 undergraduate students, two visiting graduate students and 15 postdoctoral researchers. The laboratory and physics department are part of the university’s College of Arts & Sciences.

“This big operational grant is our bread and butter,” said Itzik Ben-Itzhak, university distinguished professor of physics and director of the J.R. MacDonald Laboratory. “The grant renewal keeps us running day to day and helps us continue to perform experimental and theoretical research. It also enables us to go after developmental grants for specific projects.”

Listen to the sound of laser-induced thunder at the J.R. MacDonald Laboratory on Page 23.

A ‘bear’ necessity: Research uses webcam to study our emotional connection to wildlife, parks

If you strolled Alaska’s Katmai National Park in July, you probably enjoyed watching brown bears fish for salmon at the iconic Brooks Falls.

But what if you didn’t have to venture to Alaska to see the bears in action because you could watch on a live webcam? Would you have the same emotional response as viewing the bears in their natural surroundings?

That’s what two Kansas State University researchers want to find out through a live-stream video study of brown bears. Jeffrey Skibins and Ryan Sharp, both assistant professors of park management and conservation, want to answer an important question: Do people have the same emotional connections with animals when watching them through live webcams and in real life?

Jeffrey Skibins and Ryan Sharp are focusing the study on a “bearcam” provided by multimedia company explore.org, which is the philanthropic media organization and division of the Annenberg Foundation. The “bearcam” offers live footage of brown bears at locations throughout Katmai National Park, including the iconic Brooks Falls, where salmon jump up waterfalls and bears wait nearby to catch them.

“Ultimately we want to know how viewers are affected by seeing something online — not having an actual experience, but having the virtual experience of viewing animals in nature,” Skibins said. “Does it create a conservation behavior action within the viewer? Does it cause people to want to get involved in saving these animals?”

The research project has received financial support from K-State’s horticulture and natural resources department and K-State Research and Extension. Sweet success with new food technology that cuts calories, fat

A food technology donated to Kansas State University’s Institute for Commercialization is on the cusp of transforming chocolates and many other popular food products.

Indianapolis-based Choco Finesse LLC has introduced Epogee Fat Replacement, which can replace up to 80 percent of the fat and drop total calories by 20-45 percent in typical recipes.

The fat replacement tastes like fat that comes from natural vegetable oils. Epogee’s use in food has been confirmed by the Food and Drug Administration for candies, baked goods, spreads, nutrition bars and other foods.

Ken Williams, director of licensing for the Institute for Commercialization, said the university has been involved for several years in creating the relationships needed to advance the technology.

At the Institute of Food Technologists’ annual meeting in July, Choco Finesse unveiled a partnership with Blommer Chocolate, the largest cocoa processor and ingredient chocolate supplier in North America. Blommer will be using Epogee in a new line of chocolate coatings.

David Rowe, founder and chief president of Choco Finesse, said Epogee’s use is supported by 65 scientific studies and seven journal articles.

“The FDA has noted that Epogee’s effectiveness to safely lower calories is backed by one of the strongest databases ever developed for a new food ingredient,” he said.

Choco Finesse officials say that products containing Epogee will begin to reach consumers in 2017. For more information, visit the company’s website at epogee.net.
EPA grant to K-State engineers could help clear the air in the Windy City

Chicagoland communities most at risk for poor air quality will soon have the opportunity to participate in their own air quality monitoring with help from Kansas State University. The project, “Shared AirShed Action: Community Empowerment through Low-cost Air Pollution Monitoring,” is being conducted by three K-State researchers and seven Chicago organizations. It received a $70,000 grant from the Environmental Protection Agency to investigate if giving communities access to low-cost portable air pollution monitoring devices could help improve air quality, which is directly related to human health concerns.

Chicagoland’s environmental justice communities — areas that share a disproportionate amount of the risk in contamination and pollution from industrialization and modern society — were the focus of the project. The researchers will do a pilot study in winter 2016 and will launch the full study in spring 2017. “In a crowded city, many people and up to next to landfill, major highways or industrial areas,” said Wendy Griswold, the project’s principal investigator and Kansas State University’s Center for Hazardous Substance Research project manager. “Studies have shown that people living in lower-income, minority communities adjacent to such industrial areas,” said Wendy Griswold, the project’s principal investigator and Kansas State University’s Center for Hazardous Substance Research project manager. “Studies have shown that people living in lower-income, minority communities adjacent to such industrial areas.”

The researchers have been involved in several important findings, including:

• Culex mosquitoes, which transmit West Nile virus and Japanese encephalitis, do not appear to be involved in transmission of Zika virus to collaborative organizations for further study.

Kansas State University is helping the fight against Zika virus through mosquito research. The university’s Biosecurity Research Institute is taking a two-part approach: Researchers are studying mosquitoes to understand how they become infected with Zika virus and researchers are providing the virus to collaborative organizations for further study. The institute recently contributed to the development of a promising DNA vaccine that is safe and effective against Zika virus and could offer more affordable long-term protection. "We are hoping to provide some answers and insights into the relationship between Zika virus and the mosquitoes that transmit the virus," said Stephen Higgs, director of the Biosecurity Research Institute. Higgs and other Biosecurity Research Institute scientists — including Dana Vanlandingham, assistant professor of entomology, and Yen-Jong Huang, postdoctoral fellow in diagnostic medicine and pathobiology — have published their collaborative work in Nature Medicine, Science, and Vector-Borne and Zoonotic Diseases.

The researchers have been involved in several important findings, including:

• Culex mosquitoes, which transmit West Nile virus and Japanese encephalitis, do not appear to transmit Zika virus.

• People infected with Zika virus may not be susceptible to Zika virus again.

Zika virus is present in the blood very early during infection and remains in some tissues for a long time but is only briefly present in other tissues.

Olympics more than games to two K-State faculty members

A Kansas State University English professor used a summer stipend from the National Endowment for the Humanities to explore how Mark Twain came to be thought of as the folk writer from Missouri who opened quotient wisdom.

The NEH stipend is helping James Machor with his book project about how readers received Twain’s work. Summer stipends support advanced research that is of value to humanities scholars, general audiences, or both. The National Endowment for the Humanities funds approximately 9 percent of proposals to the program, and Machor’s award was only one of two grants in Kansas for 2016.

To determine how Twain’s readers and critics shaped the way he is remembered, Machor is looking at the way the author’s works were viewed in the last 160 years. He also is working to address a gap in Twain reception scholarship; most of the work has focused on “Huckleberry Finn,” “The Prince and the Pauper” and “Tom Sawyer,” and viewed in the last 160 years. He also is working to address a gap in Twain reception scholarship; most of the work has focused on “Huckleberry Finn,” “The Prince and the Pauper” and “Tom Sawyer.”

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They didn’t bring home a medal for their efforts, but two Kansas State University faculty members did bring home golden moments from the 2016 Summer Olympics in Rio. Bryan Pinkall, assistant professor of voice who is a professional singer with the Kansas City Chorale, assisted with the opening ceremony at the Rio Games. Pinkall was part of the performance operations team for the opening ceremony, which is one of the world’s largest artistic events. Pinkall also assisted with the opening ceremony for the 2014 Winter Olympic Games in Sochi, Russia. Philip Vardiman, director of K-State’s athletic training program, served as an athletic trainer on the medical team for U.S. track and field athletes competing at the Rio Olympics. Vardiman was selected for the medical team by the U.S. Olympic Committee. It was the first time he served at the Olympics.
Bronze Beauty

Kansas State University research helps the growth of sorghum in Kansas, worldwide
Bronze Beauty

Kansas State University research helps the growth of sorghum in Kansas, worldwide

By Pat Melgares

Each fall, a sea of bronze fills the Kansas landscape, from the most rural areas of the state to lush farm fields that are sometimes just a stone’s throw from interstate 70 and the most heavily populated cities. This is a hotbed for American sorghum, whose origins in Africa may contribute to its relative anonymity in the United States.

Also known as milo, sorghum is the beaded heads of the mature crop. The farther west you travel in Kansas, the more sorghum you’re likely to see because it is an ideal crop in areas where water is sparse.

“Sorghum is a very hardy, water-sipping crop, making it fitting for our harsh, unpredictable weather,” said Pat Damman, director of the Kansas Grain Sorghum Commission. “It also is gaining in popularity because of our growing export market. China has really made the world look at grain sorghum.”

Sorghum’s standing in the world’s agricultural economy is growing and increased funding for science is helping Kansas State University and other U.S. researchers study its uses for food, fiber and fuel.

Kansas: No. 1 in production

Kansas farmers grow the crop better than farmers in any other state. In 2014, Kansas ranked first in grain sorghum production in the United States with 200 million bushels grown — or more than 40 percent of the country’s total production.

“We rely on the drought tolerance of sorghum,” said Matt Splitter, who planted 750 acres of sorghum this year on his farm near Lyons, Kansas. “With sorghum, we are able to raise high yields even when we have long periods of drought and heat.”

Damman, who farms near Clifton, Kansas, noted that traditionally one-third of U.S. sorghum is used as livestock feed; one-third is used to produce biofuels; and one-third goes to the export market.

But in 2013, the Gun Jun Jiao Agriculture Trading Co. rocked the export market when it became the first Chinese company to import U.S. sorghum.

“In recent years,” Damman said, “nearly 80 percent of U.S. sorghum has been exported.”

“The demand for sorghum is at an all-time high because of the purchasing patterns of the export market,” said Florentino Lopez, executive director of the United Sorghum Checkoff Program, which has contributed $5.1 million since 2009 to the Kansas sorghum industry for research, market development and education.

Sorghum’s ability to survive and grow in harsh environments is largely responsible for its rising popularity for food, fiber and fuel use. Kansas State University scientists are using this hardy crop to develop new varieties that can be grown in the most severe environments in the world.
Nutrition for the hungry

The beauty of fully mature sorghum is a stark contrast to the depopulated, drought-stricken villages where the crop is a critical food product in the Masai Region of Tanzania, one of the most starving areas of the world. Kansas State University grain scientist Sajid Alavi is part of a research team working to improve child nutrition and health by providing a sorghum-soybean porridge blend to children under age 5.

The study is being conducted in partnership with Project Concern International, a humanitarian agency that combats food insecurity and poor health in 15 countries by promoting nutrition education.

“Sorghum as a staple crop is grown in this part of Tanzania and is something that is in a known and accepted part of the diet,” said Michael Mulford, country director for Project Concern International in Tanzania.

“We saw this as an opportunity, in an area where sorghum is a common and drought-tolerant crop, to look at its potential use in fortified food-blended products that help with undernutrition and are often part of supplementary feeding programs.”

Earlier this year, 2,000 children ages 6 months to 5 years and their mothers traveled up to 10 miles by foot to a central distribution point to receive the porridge blend. While the results of the five-month study are yet to be finalized, Alavi said the early indications are that children were healthier and grew at a more normal rate.

Many porridge blends — known as “uji” in Tanzania — are made of corn-soy blends. Sorghum may provide more long-term stability in this region because it can be grown in the dry, hot, climate common to many parts of Africa where millions of people consider sorghum a staple in their diets.

“This whole project was started by our own sorghum farmers in Kansas and carried through the checkoff program and the Kansas Grain Sorghum Commission,” Alavi said. “Through the checkoff program, farmers realize that the university’s work might help them in terms of gaining higher prices.”

Protecting the industry with science

In 2013, the U.S. Agency for International Development awarded Kansas State University $13.7 million to establish the Feed the Future Innovation Lab for Collaborative Research on Sorghum and Millet.

The five-year project focuses on advancing the science of sorghum and pearl millet in semiarid regions of the world. The award was a huge boost to a university already well-positioned to conduct research on climate-resilient crops.

USAMID also recently awarded another $1.08 million to the lab, supporting a genome-assisted breeding platform in Haiti.

“We’re confronting stresses to crops that we see everywhere in the world before they get to the United States,” said Tom Chalupa, the lab’s director and a professor of agricultural economics at Kansas State University.

“Largely, the solution that we’ve found at this time have been through exploitation of genetic diversity around the world,” Chalupa said. “That’s a huge benefit to the U.S. That’s why it’s important that we have researchers on campuses who are involved in breeding for the Kansas

sorghum community and who also are involved with international sorghum. They can take advantage of these genetic traits, where possible.”

In the 1930s, the tiny greenbug aphid became a giant pain to U.S. sorghum producers, causing economic losses of at least $43 million. The U.S. Department of Agriculture Genebank in the country’s corn belt stocks to develop pest-resistant sorghum on soybean and 1,651 million in economic losses for the nation’s farmers in 1939 alone in the Midwest out of $716 million in 2011 dollars.

The new bully at U.S. sorghum fields is the sugarcane aphid, which in the past three to four years has pushed its way from Louisiana to Kansas, and recently into the Rio Grande Valley in south Texas and northern Mexico. Sorghum, originally from Africa, is a critical food product for U.S. researchers develop varieties to combat the pest.

Research unlocks sorghum’s potential

Geoffrey Morris, an associate professor of agronomy at Kansas State University, develops genetic tools that sorghum breeders use to create new varieties.

Traditional breeding techniques usually take 12-15 years to develop new varieties of sorghum. Morris and his research team are at that time is to back trace the genetic markers and developing genetic tools that breeders use to create new varieties.

One project funded by the Sorghum and Millet Innovation Lab is developing germplasm to produce new varieties, as well as training Research in developing drought-tolerant varieties for the US. In 1998, the sorghum checkoff funded the sorghum checkoff research.

Another project supported by the Kansas Grain Sorghum Commission is developing climate-resistant sorghum for Kansas farmers.

“We look for genetic differences that help plants cope with climate stress. We can raise viability of water and chilling stress early in the season,” Morris said.

“Chilling tolerant sorghum would allow Kansas farmers to plant early and capture more of the moisture from early season rain,” Morris said. “It could maximize yield by avoiding the growing season, and also give Kansas farmers more options for their rotations by having a sorghum variety sensitive to the same stress.”

In Kansas, the work means that farmers like Splitter worry less about what they’re planting in their field.

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The discovery of the wheat blast fungus in Bangladesh earlier this year served notice to the world’s farmers and scientists that no one is safe from a disease that has wreaked havoc in South America for more than two decades.

“It’s really scary,” said Barbara Valent, Kansas State University distinguished professor of plant pathology. “Before February, wheat blast was never reported outside of South America.”

Wheat blast thrives in warm, wet environments, the exact conditions that Bangladeshi farmers dealt with as the wheat crop was heading this year.

“They started seeing symptoms that spread very quickly across whole fields,” Valent said. “It affected about 15 percent of the wheat crop in Bangladesh.”

That translates to an estimated 162,000 wheat acres lost, small by U.S. standards but a significant amount to Bangladeshi farmers. Many burned entire fields in an attempt to rid their farms of the fungus. It may not be enough.

“The fungus is just too widespread,” Valent said. “It’s probably finding a different host in the country, which will help it stay around. We’ve sequenced strains from five states in Bangladesh, and they are basically identical. It appears to be a single recent introduction from South America. The fact that it’s so widespread is puzzling.”

Valent is leading a major research project funded by the U.S. Department of Agriculture’s National Institute of Food and Agriculture. The team includes more than a half dozen researchers from Kansas State University plus scientists from six other universities, the USDA and agricultural agencies in Brazil, Bolivia and Paraguay.

Scientists hustle to stay on top of wheat blast fungus

In fact, the research team recently discovered a resistance gene called 2NS that has helped control the disease in Bolivia and Brazil.

“The Bangladeshi strains behave like the most aggressive strains we’ve seen from South America,” said Valent, adding that the 2NS resistance together with fungicide treatments should help but it is unlikely to stop the spread of the disease in the near future.

“This fungus is notorious for being able to overcome resistances,” she said. “We need more resistance genes, and that’s what we’re focused on now. It’s a safety backup, some of the fungi in South America already is able to overcome the 2NS gene.”

Valent said that Australian scientists are monitoring the situation in Bangladesh closely. She said that with the fungus already jumping one ocean, her Australian colleagues are expressing concern about wheat blast reaching their country.

“It’s an important time to stay on top of it,” she said.

Valent’s team developed an extension publication, “Identifying Wheat Diseases Affecting Heads and Grain,” that provides agricultural specialists and farmers needed information to identify wheat blast if it occurs in U.S. fields. More than 32,000 copies of this publication have been distributed in 29 states and Canada. The publication is available from the Kansas Agricultural Experiment Station.

Industry, university helping each other

Dunnam noted that the Kansas Grain Sorghum Commission invests approximately $1.2 million each year to help the industry. Much of that, he said, supports research at Kansas State University.

“Historically, sorghum hasn’t had the research investments that a crop like corn has had, but that means that research investments now can have a huge effect on accelerating sorghum breeding,” Morin said.

Burton said that there are increasing opportunities to fund sorghum research. The Sorghum and Miller Innovation Lab, for example, is funding more than a dozen projects at U.S. universities and in several countries.

“We are telling about somewhere between $2 million to $5 million annual investment in this international research program that has trained students and has incredible international benefits, including improving food availability and training scientists so they can have their own research agenda. The benefits to the U.S. because of this have been phenomenal,” Burton said.

“What we did at K-State was we kept our programs moving along and we were always linked to producer demands in Kansas,” he said. “When agencies and industries became more interested in sorghum, we were in the right place at the right time. We were ready to broaden out and continue what we were doing in the past at a greater scale.”

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Eleni Pliakoni and colleagues have an appetite for fresh produce production and storage research. An assistant professor of horticulture and natural resources at the Kansas State University Olathe campus, Pliakoni specializes in urban food production and postharvest handling, or how the handling procedures of fresh fruits and vegetables affect these foods and what techniques safeguard their quality and extend their shelf life.

“Fresh fruits and vegetables are very diverse, so there is not one postharvest-handling approach that will work for all,” Pliakoni said. “For example, tomatoes and broccoli cannot be stored at the same temperature. Because of the differences between fresh fruits and vegetables, we are required to use multiple techniques to develop different handling methods for every type of product.”

Pliakoni collaborates with Cary Rivard, assistant professor of horticulture and natural resources, extension specialist and director of the Horticultural Research and Extension Center in Olathe, Kansas, and Helena Pontes Chiebao, postdoctoral research associate in Pliakoni’s lab. Pliakoni also leads a team of three graduate students who conduct research on various fruits and vegetables.

The researchers are focusing on a combination of tools and techniques, ranging from temperature control to low-cost greenhouse alternatives, to maintain taste and nutrition while extending the shelf life of fresh produce grown by smallholder Kansas farmers. These small-acreage farmers have fewer than 10 acres of land and represent more than half of the vegetable producers in the Midwest.

Helping smallholder farmers increase the
availability of locally grown, fresh fruits and vegetables in metropolitan areas is important for several reasons, Pliakoni said. Urban populations are continuing to grow. Also growing is consumer interest in locally produced food and farmers markets, which account for more than $10 billion in annual sales. Even more pressure will be placed on local food systems as the world’s population balloons to a projected 9.6 billion people by 2050.

Because there is no “one-size-fits-all” approach to produce handling, there is a great need to develop research projects to improve the storage and transportation of produce, especially in high tunnels. Most agricultural research has taken place in high tunnels on the quality of produce. She has found that produce grown in high tunnels has a longer shelf life, which makes fruits and vegetables more marketable and adds to growers’ profits.

“Modifying a produce bag to maintain the quality of the produce inside and extend its shelf life. Typically the bags are flushed with a gas mixture that has decreased oxygen and elevated carbon dioxide content. Bags are produce-specific and designed for a specific optimum temperature. The problem with this type of packaging is that it is designed only for a certain temperature,” Pliakoni said. “It does not fluctuate is throughout its journey. That makes it challenging to design a singular package that adjusts to above-optimum temperatures to identify possible improvements. The researchers then plan to collaborate with a packaging company to manufacture a better packaging solution for spinach kept at ambient temperatures.”

Modified atmosphere packaging

Batzia also is working with modified atmosphere packaging. Modified atmospheres is the practice of changing the composition of the internal atmosphere of a produce bag to maintain the quality of the produce inside and extend its shelf life. Typically the bags are flushed with a gas mixture that has decreased oxygen and elevated carbon dioxide content. Bags are produce-specific and designed for a specific optimum temperature. The problem with this type of packaging is that it is designed only for a certain temperature,” Pliakoni said. “It does not fluctuate is throughout its journey. That makes it challenging to design a singular package that adjusts to above-optimum temperatures to identify possible improvements.”

Researchers on the Agriculture and Food Research Initiative project are working on a possible solution: improving the storage efficiency of this packaging by identifying proper atmospheric conditions for bags kept in ambient temperatures. They are storing spinach in commercial bags in above-optimum temperatures to identify possible improvements. The researchers then plan to collaborate with a packaging company to manufacture a better packaging solution for spinach kept at ambient temperatures.

Hot water treatment

One of the objectives of the Agriculture and Food Research Initiative project with the University of Florida is using hot water treatments and sodium acid to reduce microbial rot on tomatoes and spinach. Produce is dipped into water heated to 131 degrees Fahrenheit. The temperature, which researchers are tweaking for optimal results, controls the natural microbes on the surface of the produce. Microbes cause decay, particularly if they enter a crack in the skin of the produce.

Seek Fall 2016
The sounds of STEAM
Grab your smartphone and lend an ear. Listen to the multidisciplinary symphony of research in science, technology, engineering, art and mathematics.

By Jennifer Tidball

A KANSAS STATE UNIVERSITY RESEARCHER makes a discovery and no one is around to hear it, doesn’t it make a sound? Of course it does. We collected the sound bites to prove it.

The perception of sound is more than a philosophical thought experiment. Sound plays an active role in STEAM — science, technology, engineering, art and mathematics — research at Kansas State University. These research noises come from laboratories, studios, industrial plants and the great outdoors.

This interactive text describes research projects at Kansas State University and the sounds associated with them. Scan the QR codes with your smartphone to hear the research beeps, squeaks, pitches and fractures.

To hear the sounds of STEAM scan QR codes or go to k-state.edu/steam.

When the countdown reaches zero, the TOPMARK II nuclear reactor facility executes its special capability: a reactor pulse. With a loud “ca-chunk,” the reactor ejects a control rod using air pressure, which causes the power to increase by a factor of 100 million in 0.01 seconds and then rapidly return to low power. Six seconds later, a “clank” means the rod has fallen back into place in the core.

The special capability produces a large amount of neutron flux in a short period of time, which can be used for analyzing materials and developing radiation detectors, said Jeff Geuther, nuclear reactor manager.

The nuclear reactor, part of the mechanical and nuclear engineering department, has other important research capabilities and also supports academic and education programs, industrial service and outreach.

The Flint Hills are alive with the sounds of bison, bugs, birds and burning. Those sounds are part of research at the Konza Prairie Biological Station, an 8,600-acre native tallgrass prairie jointly owned by Kansas State University and The Nature Conservancy. The Konza Prairie — nestled in the Flint Hills just south of Manhattan — provides an outdoor laboratory for long-term ecological research, education and prairie conservation.

Research at the Konza Prairie includes watershed-level experiments focused on tallgrass prairie ecosystems and the effects of fire, bison grazing and cattle grazing, as well as other basic biological research. A recent study found that more frequent burnings in the Flint Hills are needed to keep the tallgrass prairie ecosystem from transitioning to woodland, said John Briggs, director of the Konza Prairie.

Listen to a reactor pulse from the nuclear reactor facility.

Nuclear noises

A natural symphony

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Listen to researchers and a fire crew conduct an experimental burn at the Konza Prairie.

The sounds of STEAM

Grab your smartphone and lend an ear. Listen to the multidisciplinary symphony of research in science, technology, engineering, art and mathematics.

By Jennifer Tidball

IF A KANSAS STATE UNIVERSITY RESEARCHER makes a discovery and no one is around to hear it, does it make a sound? Of course it does. We collected the sound bites to prove it.

The perception of sound is more than a philosophical thought experiment. Sound plays an active role in

STEAM — science, technology, engineering, art and mathematics — research at Kansas State University. These research noises come from laboratories, studios, industrial plants and the great outdoors.

This interactive text describes research projects at Kansas State University and the sounds associated with them. Scan the QR codes with your smartphone to hear the research beeps, squeaks, pitches and fractures.

To hear the sounds of STEAM scan QR codes or go to k-state.edu/steam.

When the countdown reaches zero, the TOPMARK II nuclear reactor facility executes its special capability: a reactor pulse. With a loud “ca-chunk,” the reactor ejects a control rod using air pressure, which causes the power to increase by a factor of 100 million in 0.01 seconds and then rapidly return to low power. Six seconds later, a “clank” means the rod has fallen back into place in the core.

The special capability produces a large amount of neutron flux in a short period of time, which can be used for analyzing materials and developing radiation detectors, said Jeff Geuther, nuclear reactor manager.

The nuclear reactor, part of the mechanical and nuclear engineering department, has other important research capabilities and also supports academic and education programs, industrial service and outreach.

The Flint Hills are alive with the sounds of bison, bugs, birds and burning. Those sounds are part of research at the Konza Prairie Biological Station, an 8,600-acre native tallgrass prairie jointly owned by Kansas State University and The Nature Conservancy. The Konza Prairie — nestled in the Flint Hills just south of Manhattan — provides an outdoor laboratory for long-term ecological research, education and prairie conservation.

Research at the Konza Prairie includes watershed-level experiments focused on tallgrass prairie ecosystems and the effects of fire, bison grazing and cattle grazing, as well as other basic biological research. A recent study found that more frequent burnings in the Flint Hills are needed to keep the tallgrass prairie ecosystem from transitioning to woodland, said John Briggs, director of the Konza Prairie.

Listen to a reactor pulse from the nuclear reactor facility.

Nuclear noises

A natural symphony

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Unmanned aircraft systems, or UAS, are a common sound at the Kansas State Univ-
ity Polytechnic Campus. After a few
start-up beeps and noises, the whirling of
motors and blades begins and the UAS is
ready for takeoff.

Kansas State Polytechnic is a national
leader in UAS research, education and
industry projects. The Applied Aviation Research Center, which
completes hundreds of missions yearly
for the university’s Vet-

Researchers with the university’s Veter-
inary Health Center are improving the
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Dog’s best friend:
Humans are fetching up new ideas to improve health of canine companions
By Stephanie Jacques

A DOG’S SMILE — THAT DROOLING, BAD-BREATH SMILE — warms a dog lover’s heart and begs for a pat on the head or a scratch behind the ears. Kansas State University researchers and veterinarians are giving that and more to improve health for man and his best friend.

College of Veterinary Medicine researchers are extending pets’ quality of life while learning more about diseases that cross the species border between animals and people, such as breast cancer, bone cancer and arthritis.

"Similarly to how diseases in animals have been studied to advance human health, what we know about human diseases also can be applied to animal health," said Denver Marlow, university veterinarian and director of K-State’s Comparative Medicine Group.

“There are many noninfectious, naturally occurring diseases that affect both animals and humans.”

According to researchers in the College of Veterinary Medicine, understanding and treating dogs with naturally acquired diseases can provide insight into human diseases since dogs have cellular similarities to humans, often share human environments and can share diseases.

“It all goes back to One Health,” Marlow said. “What we learn about animal health helps advance veterinary and human medicine, as well as the discovery of new vaccines, drugs or therapies for treating or preventing diseases in animals and humans.”

The One Health concept that human health is linked to animal and environmental health encourages collaboration among human health professionals, veterinarians and scientists on various stages of research — basic research in a lab, model system testing, safety testing and, finally, clinical trials.

Among those working on health-related research in the college are three researchers who are at various research stages and who are specifically investigating diseases that affect dogs and humans.
Deciphering canine cellular communication

Understanding the secret language of dogs is more complex than figuring out what wood, bark and howl mean. Annaline Nguyen, associate professor of diagnostic medicine and pathology, is looking deeper at canine cancer cell communication — or lack thereof. The research is based on her previous work with human breast cancer.

“There is a lack of understanding of cell-to-cell communication,” Nguyen said. “Normal cells have great communication and regulation. We do not see that with cancer cells. We want to learn more about how the loss of cell communication is driving the force of cancer.”

According to Nguyen, current cancer treatments in dogs kill all cell growth — harming healthy cells — in order to prevent the cancer cells from growing. Nguyen is looking for a more targeted approach that could open up closed communication channels called gap junctions in cancer cells and allow proteins that regulate cell growth back into the cell.

“The approach already has been successful in Nguyen’s human breast cancer research and resulted in a patent,” said Wouda. “If the communication blockage is there in humans, it could be in dogs, too.”

“While we do not know what is driving this phenomenon, we have found that cancer cells are not communicating with the other cells around them,” Nguyen said. “Our studies show that cancer cells are losing their ability to communicate with normal cells and this increases the spread of cancer, critical to its survival.”

A veterinary student working in clinics, Nguyen’s work has never been more critical. In 2016, her research was confirmed when a cancer patient experienced a sudden drop in her cancer cells. Nguyen said the drop in cancer cells correlated with an increase in her communication proteins.

“As a veterinary student working in clinics, I’ve seen several dogs get cancer — nearly every one above the age of 10 — so I wanted to make a change.”

Nguyen and Luu said the targeted approach could prolong dogs’ quality of life and give a companion to what the therapy can do for humans.

“If a dog gets cancer at 10, we do not want to see our cancer death but we can prolong their quality of life,” Nguyen said. “This is an approach, a treatment, that could save two dogs — that’s worth it in dog time, that’s long time. In humans, a comparable time frame would give more time to a patient for personal care.”

Give a dog a bone-fighting chance

Built into a veterinarian’s DNA is a love for animals and a desire to improve their health and welfare. Rachelne Wouda, assistant professor of clinical sciences, is such a soul who is trying new treatment approaches to give her patients and their owners hope.

Wouda and her colleague Mary Lynn Haggard, associate professor of clinical science, oversee an active clinical trials program at K-State’s Veterinary Health Center. One of their current clinical trials is enrolling dogs diagnosed with hip arthritis, followed the patients for six months after placebo or mesenchymal cell therapy. The study was a double-blind, placebo-controlled clinical trial, which means the veterinarian and the dog owner did not know which dogs received the stem cell treatment and which received a placebo injection.

“Our pet dogs live longer now than they used to because of a combination of improved veterinary care and improved client care,” Wouda said. “Consequently, we have the opportunity to answer critical research questions in a study that usually involves a population of dogs with comparable diseases, shared environmental circumstances, access to high-level health care, and comparatively shorter lifespans — one dog year equals seven human years. Many of these families and their fearful owners are willing to pursue investigational therapies provide a steppingstone for improving the outcomes of both pets and humans with cancer.”

The osteosarcoma clinical trial at K-State is part of a multi-institutional trial overseen by the National Institutes of Health National Cancer Institute’s Comparative Cancer Research Center and its comparative oncology program.

Nationally, the clinical trial has now enrolled more than 150 of the 200 dogs enrolled across nine institutions to research the therapeutic potential of mesenchymal stem cells, which Nguyen said could also be used to treat inflammatory arthritis in humans. Preclinical research suggests that mesenchymal stem cells may inhibit the spread of disease to the lungs, which is common in the late stages of osteosarcoma. Wouda believes the successful clinical trial in dogs can be extended to humans in the future.

“With more than 1,200 dogs with osteosarcoma enrolled since 2012, the success of the K-State osteosarcoma trial could be extended to humans,” Wouda said. “We are extremely excited that our study showed that stem cells were safe and had a positive effect.”

Wouda is recalling the dogs involved in the study to make a case to start a similar clinical trial in humans with arthritis.

“The potential of these findings to inform and translate human medicine is huge,” Wouda said. “We can safely and effec- tively treat dogs with arthritis, then we can make a case to use stem cells for treating humans with inflammatory diseases.”

Arthritis relief stems from cells

Mark Weiss, professor of anatomy and physiology, has unbiased data to change the game of fetch for dogs with inflammatory diseases.

Wouda has finished a clinical trial that used stem cells in dog to decrease pain from osteoarthritis, also a disease that affects humans. The study showed objective data — a first in canine studies with stem cells — that the therapy is effective at reducing pain.

“The preclinical data suggests that mesenchymal stem cell therapy could be dosing-regulated — a game changer,” Weiss said. “We wanted to see if we could make clinical improvements in the animals. That’s what we got.”

The study, which enrolled 22 dogs diagnosed with hip arthritis, followed the patients for six months after placebo or mesenchymal cell therapy. The study was a double-blind, placebo-controlled clinical trial, which means the veterinarian and the dog owner did not know which dogs received the stem cell treatment and which received a placebo injection.

“There is a placebo effect, even in dogs,” Weiss said. “Part of the problem is that dogs are not the ones telling you they feel better. Dogs attempt to please their owners, and if owners are biased and expect to see an improvement in their dogs, then there is a placebo effect in the short term.”

The computer measurements from a pressure-sensing walkway showed that dogs that received stem cells — collected from the dogs’ intestinal tract — had mod- est improvements in weight distribution within the first month after the injection. The walkway provided measurable data in addition to subjective data from owner and veterinarian surveys that indicated that dogs that received the treatments had significant functional improvements.

“We had one-month, two-month, three-month and six-month measurements from the walkway after treatment,” Weiss said. “At one month, the treated dogs showed improvement and then remained improved six months later. We are extremely excited that our study showed that stem cells were safe and had a positive effect.”

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A pressure-sensing walkway provides objective data of a dog’s pain severity by measuring how much weight the dog put on each foot — a first in canine stem cell studies.

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WHEN IT COMES TO BETTER PREPARING KIDS ON THE AUTISM SPECTRUM FOR LEARNING and social environments, Kansas State University’s drama therapy program is showing how theatre techniques can have a starring role.

Graduate students in the K-State program, one of only five such university programs in the country, collaborated with a Kansas school district to offer six-week summer camps this year for three groups of kids from middle school to high school. One of the graduate students also delivered drama activities twice a week to attendees of the Flint Hills Summer Fun Camp, which offers summer activities designed to build social skills and compassion and maintain academic skills in kids both on and off the autism spectrum.

Sally Bailey, K-State professor of drama therapy, supervised second-year graduate students Mike Rogers, Sarah Edwards and Sherry Brown as they provided the camps for about 30 kids this summer. Bailey’s students also work with the school district’s after-school programs during the academic year.
The strength of this partnership helps draw graduate students to K-State, along with faculty and staff. Edwards and Brown also have gained perspective from the students on the autism spectrum.

"Drama helps kids express themselves vocally and physically, helps them interact appropriately socially, develops self-confidence and increases imagination and problem-solving skills," Bailey said. "Rain or the autism spectrum are able to practice social and communication skills in a fun, motivating way."

The collaboration between the K-State drama therapy program and USD 383, the Manhattan-Ogden School District, is the only one of its kind in the country. The after-school and summer activities — which Bailey characterizes as a partnership with the drama therapy program, the school district and the university from infancy to very beginning — have grown. Based on the after-school program’s success, a summer camp offered four years ago morphed into four separate camps in summer 2014. The camps were organized by the autism department at USD 383 and other activities for the students’ range of needs and ability levels.

The strength of the partnership helps draw graduate students from around the country with a range of experiences. Brown completed her undergraduate degree at K-State in secondary education with a concentration in speech and theater. Rogers earned a Bachelor of Arts from Baldwin State University in Georgia and lived in Hong Kong, where he taught English and dramas for the last five years before coming to Manhattan to study drama therapy. Edwards came to K-State after completing a Bachelor of Fine Arts in theater education at Belmont University in Nashville.

As more students come to K-State to study drama therapy and benefit from this ongoing community connection, a second drama therapy professor will be needed.

"We value partnerships and the attraction they have for our students, where we can reach out to the region to share the same ways in which the arts can be used to enrich people’s lives," Jeffery Ward, director of the School of Music, Theatre, and Dance in the College of Arts & Sciences at K-State, said. "Kimberly Rieckmann is the mother of a student in the high school film camp. Her son has been with the program since it began four years ago as an after-school group for middle schools. Kimberly Rieckmann provided her group with a more general approach to Social Adventures Camp aimed at middle school. The students developed the concept and the story and built sets and scenery for the first time this year."

"The creative process isn’t always smooth. Campers experience many differences of opinion, but Edwards always ensured they found a positive solution. In a regular school environment, teachers and staff may not have the time to do that, and it makes a difference in how the students relate. Edwards noticed students nurturing conflict with each other to help build skills because of the positive relationships they established."

Brown’s group worked on more basic social skills by learning about emotions. She said a variety of games and art activities to support that goal. One popular activity is feelings yoga, which couples a physical pose with an emotion: students stretch upward to depict a grateful emotion; or fold their arms to become a hugging bear. They have daily lessons in which to give a courteous compliment. Nonverbal students or students who had longer processing time participated. The group doesn’t leave them behind.

"One of the major lessons Brown has learned is that students on the autism spectrum shouldn’t be babied. One of my concerns for any young person is isolation — the mental storm that causes," Miller said. "Depression and anxiety can become full blown in kids on the spectrum. It’s mitigated by having friendships and helping people who are in the same boat. These kids could be incredibly supportive of each other. It’s good for their mental health."

Support from Bailey and K-State is crucial to the success of the after-school fun clubs and summer camps. "Without these grad students doing drama therapy, I don’t know where I’d be or feel like I’d have that knowledge," Miller said. She also is thankful that kids on the autism spectrum are offered an opportunity to use creative outlets instead of being isolated in front of television or video games.

"The kids reporting a sense of belonging is the most encouraging thing," Miller said. "They’re capable of doing things on their own," she said. "It’s one of my concerns for any young person is isolation — the mental storm that causes." Miller said. "Depression and anxiety can become full blown in kids on the spectrum. It’s mitigated by having friendships and helping people who are in the same boat. These kids could be incredibly supportive of each other. It’s good for their mental health."

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The autumn is building relationships and social skills by helping students use teamwork to act out a story, identify their own emotions and recognize them in others, and make better choices in their reactions to difficult situations. Drama activities also level the playing field between peers and students on the autism spectrum because everyone is a little nervous when developing or acting out a story. She said the drama activities provided by Rogers work well because he encourages the group to take risks together. "When I first think it’s the biggest and most obvious impact is for students who are nonverbal and lack communication skills, because they are able to participate fully in drama," Smith said. "They can act something out in a way that doesn’t require language and participate in a story in a way that involves them."

Along with building flexibility and collaboration skills, another benefit of the summer camps is friendship. Kimberly Rieckmann is the mother of a student in the high school film camp. Her son has been with the program since it began four years ago as an after-school group for middle schools. Rieckmann said the camps are a tremendous experience, and that each camp caters to students’ specific needs such as socializing or expressing emotions. She’s thankful for the friendships the students have formed.

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Successful teachers make subject matter come alive for students. Kansas State University’s College of Education and its specially produced documentaries are helping teachers do just that for a variety of education-related topics.

The college’s documentary about a turbulent period in Kansas history is helping teachers show students how escaped slaves risked their lives to gain freedom with the help of Wabaunsee County, Kansas, abolitionists.

“Dawn of Day: Stories from the Underground Railroad” was released in May 2016, and free lesson plans and DVDs of the 53-minute documentary are available for teachers. The film is also available online along with others the college has produced since 2012 thanks to the efforts of Rusty Earl, the college’s video producer.

Earl enjoys the challenges and rewards of the filmmaking process.

“When you dig into people’s history and find out what they sacrificed, you get to know them. I like to show the best side of human beings,” he said.

Earl has displayed the best of humanity several times, and his efforts have brought national and international attention to the college. A 15-minute film called “Life in a Jar: The Irena Sendler Project” chronicled how three Kansas students used a school project to learn and tell the story of an unsung hero in Poland who helped save more than 2,500 children from the Warsaw Ghetto in 1942. The video has been viewed more than 60,000 times, and has played on KTWU, a public television station in Topeka, Kansas.

K-State’s College of Education, with Earl, also developed a video series called “A Walk in My Shoes” to build awareness about students’ diversity, challenges and opportunities. The first two videos in the series were about international and military-connected students. The third, a 2014 piece about first-generation students, was featured as a blog entry by first lady Michelle Obama and has been seen by students and staff at more than 100 universities and junior colleges, partially because of promotion from NACADA: The Global Community for Academic Advising (see Page 34). A new film about social justice in education premiered in October 2016.

Backyard history

“Dawn of Day” differs from the other documentaries produced by the College of Education because of the level of historical research it required.

“So much research has been done and can still be done,” Earl said. “New discoveries are being made. We were only recently able to say there was an underground railroad stop near Manhattan, Kansas.”

After separating fact from fiction and doing more research than for any other project, Earl and his team decided to concentrate on Wabaunsee County. The film dramatizes the flight of an escaped slave and shows actual locations where slaves were sheltered. Local experts discuss landmarks, historical documents, family history and the overall effort of those who risked working or traveling on the Underground Railroad.

One of those experts is Richard Pitts, director of the Wonder Workshop Children’s Museum, a Manhattan nonprofit that offers exhibits and programs to the public as well as camps and after-school programs for kids. Years of working with local youth have shown Pitts that knowledge of heritage and local history is lacking.

“Schools don’t teach much about Native American or African-American history,” Pitts said.

Pitts has found that kids of European ancestry may know they are German or Italian, but they don’t know about contributions of different groups. He said African-American youth tend to lack knowledge of their histories, so he has tried to help. He shared stories, and he made a timeline with Wonder Workshop attendees and had them add contributions of their ancestors. He also started offering tours in 1997 of Underground Railroad sites in Riley and Wabaunsee counties with the objective of bringing people together.

“This is a story that needs to be told over and over again because it shows that we have always worked together in one way or another. It’s not polarizing — it’s something that brings unity,” Pitts said.

Brad Burenheide, associate professor of curriculum and instruction, agreed.

“The documentary is a great example of what local and public historians can do to impact society’s understanding of history and the events that matter,” Burenheide said.

Burenheide is featured in the film. At one point, Pitts asks Burenheide why it’s important to study the Underground Railroad. “My answer is that it offers an episode in history that shows we can do right. Humanity can do the right thing, even in the most dire of circumstances,” Burenheide said.

“Dawn of Day” used family histories and other documents to tell the story of Underground Railroad operations in Kansas. Right: Rusty Earl films a scene with local expert Richard Pitts and associate professor Brad Burenheide.

“When you dig into people’s history and find out what they sacrificed, you get to know them. I like to show the best side of human beings.” — Rusty Earl

Left: “Dawn of Day” used family histories and other documents to tell the story of Underground Railroad operations in Kansas. Right: Rusty Earl films a scene with local expert Richard Pitts and associate professor Brad Burenheide.
He also is excited about engaging teachers and students to explore their own areas, and Pits hopes that more people will start looking in their own backyards or find among horses in their towns.

“History not only shows us our past, but imparts us and shows us our potential. People have done extraordinary things with limited resources,” Pits said. “History helps us realize whose shoulders we’re standing on. We all contributed to this America that we hold so dear.”

More than marketing

The College of Education expresses a breadth and depth of information through the documentaries that conventional marketing brochures can’t convey.

Burenheide said community members have approached him about the "Dawn of Day" documentary, which aired on a Yoakum public television station. "They say, ‘What else do you do in the college?’ It's creative, unique and lasting,” he said.

"History is important," said Debbie Metz, dean of the College of Education, which is the largest teacher preparation program in Kansas. “We don’t want part of our history to be forgotten or assume that children are going to automatically know or pick up on what we think is important. We need to be very purposeful in what we share and what we teach them.”

Along with more “Walk in My Shoes” films, plans are in the works for another ambitious documentary that follows several first-year teachers in schools across Kansas. The new teachers will keep video diaries that capture their daily challenges and successes.

“The response to our documentaries has been overwhelmingly positive, and I believe that is because we are addressing more of importance and we are doing so thoughtfully and respectfully,” Mercer said. “Rusty is a unique talent in that within him the art and science of videography and the art and science of teaching converge.”

“The videos bring validity to the great community work our faculty do,” Earl said. “They also show that we care more about our students and what we are doing.”

Along with helping students, NACADA also works with its "Walk in My Shoes" films to foster collaborative research between faculty and primary advisors. Charlie Nutt, NACADA executive director, said research in the field is thriving.

“Currently, some bases design their own treatment or what length of treatment is most beneficial in reducing risk,” Stith said. “We want to provide a more standardized approach.”

NACADA: The Global Community for Academic Advising calls the K-State College of Education home. The organization supports advising professionals at K-State and around the world. It also seeks to foster collaborative research between faculty and primary advisors, Charlie Nutt, NACADA executive director, and research in the field is thriving. Serving first-generation college students is a major focus.

NACADA has made the College of Education’s "A Walk in My Shoes: First-Generation College Students" documentary available as a resource to its 14,000 members worldwide.

"Many are using the first-generation documentary, and the materials are available online," Nutt said.

"Workshops have been presented all over the country based on the information in the documentary and its companion e-book."
Just call Sarah Jones a super sleuth. The senior in food science and industry is spending part of her last year at Kansas State University diving into just how long people have been concerned about the connection between human and animal health. At least 150 years, it turns out.

Jones’ interests have taken her from her hometown of Riverton in southeast Kansas to Washington, D.C., in spring 2016 where she started with officials from the Food and Drug Administration, the Congressional Research Service and others, to Bethesda, Maryland and the

National Library of Medicine archives this summer. While in Bethesda, she delved into hundreds of historical documents and photos, including a review of the One Health philosophy advocated by Dr. John Shaw Billings in 1879.

As the Food and Drug Administration develops new regulations that provide for more direct veterinary oversight of antibiotic use in livestock production, the Veterinary Food Directive will be fully implemented in December 2016.

By Mary Lou Peter

Search for knowledge is not complete; more is constantly emerging in the food industry such as rapid chilling and sub-arctic heating to provide food preservation, in addition to novel interventions and chemical chloramines used to clean equipment, may actually be leaking to a broader ground for stronger, more resistant microorganisms, Jones said.

John Shaw Billings’ One Health approach, sparked by diseases at the turn of the 20th century, held that human and animal health were inextricably linked. His beliefs were not well received in his time.

When in Bethesda, she delved into hundreds of historical documents and photos, including a review of the One Health philosophy advocated by Dr. John Shaw Billings in 1879.

By Sarah Caldwell Hancock

Castellanos has built a mobile bioenergy lab, for example, and explored how art, medicine and virtual reality can help tell stories of water quality in Wuhan, China.

Carla Castellanos’ blend of citizen science and art led to a creative approach to measure water quality in Wuhan, China.

Laypeople, artists and scientists see the world and its problems differently. Interest in their diverse ways of knowing and in bridging where they can create new knowledge has led Carla Castellanos, assistant professor of art at Kansas State University, to take on some unusual projects.

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Carla Castellanos’ blend of citizen science and art led to a creative approach to measure water quality in Wuhan, China.

Laypeople, artists and scientists see the world and its problems differently. Interest in their diverse ways of knowing and in bridging where they can create new knowledge has led Carla Castellanos, assistant professor of art at Kansas State University, to take on some unusual projects.

Castellanos has built a mobile bioenergy lab, for example, and explored how art, medicine and virtual reality can help tell stories of water quality in Wuhan, China.

Carla Castellanos’ blend of citizen science and art led to a creative approach to measure water quality in Wuhan, China.
Patented discoveries vanquish viruses, boost batteries, advance agriculture

By Tiffany Roney

Kansas State University faculty and students are some of the most innovative people around. The following original methods and devices are among the patents the university earned in 2016 — with additional patents expected by year-end.

Macrocyclic and peptidomimetic compounds as broad-spectrum antivirals against 3C or 3C-like proteases of picornaviruses, caliciviruses and coronaviruses

Inventors: Kwang-Ok Chang, professor of diagnostic medicine and pathobiology; Yunjeong Kim, associate professor of diagnostic medicine and pathobiology; and Govind Paneru, graduate research assistant in diagnostic medicine and pathobiology; and Yunjeong Kim, associate professor of diagnostic medicine and pathobiology; and Yunjeong Kim, associate professor of diagnostic medicine and pathobiology; and Govind Paneru, graduate research assistant in diagnostic medicine and pathobiology.

Many important human and animal viruses share a common thing — a specific type of virus protease. The 3C-like proteases of picornaviruses, caliciviruses and coronaviruses are important viral enzymes that regulate viral replication and viral protease inhibitors are therapeutic and/or prophylactic agents.

Several homologous fields can thank K-State for a new helpful tool. These compounds can manipulate and some characteristic of individual cells in transplant procedures. Before this tool, there were few measurements and little characterization at the single-contact cellular level. Whereas conventional scalpels and cyanide are too long and bulky to remove surrounding tissue and cells for transplant procedures, this sleek device can get in close and do the job.

Electrochemically-grown nanowires and uses thereof

Inventors: Brent N. Flanders, associate professor of physics; and Geoffrey Parmer, graduate research assistant in physics.

Wouldn’t it be great if batteries could last longer and charge quicker? Thanks to K-State, there’s a new kind of battery that can do just that. This battery uses silicon rather than graphite or other carbonanodes, which are common anodes in current commercial batteries, so it provides higher capacity limits, shorter charging periods and significantly longer battery lifetime. The development will be key for energy supply in future hybrid and all-electric vehicles, portable electronics and other applications.

Lithium-ion battery anode including core-shell heterostructure of silicon coated vertically aligned carbon nanofibers

Inventors: Ronald A. Rojeski, Catalyst Power Technologies; Klankowski, K-State doctoral graduate; Phong Tuan Nguyen, doctoral student in chemical engineering; and Michael R. Seacrist, SunEdison Semiconductor.

What’s stronger than Superman? The answer may be graphene. It’s the strongest known natural material, and it also has high thermal conductivity — 2,500 times that of silicon — and high optical transparency — 97 percent work-through — as well as a z-flexible structure, meaning it can bend to each use. This invention, a new method of large-area, high-quality graphene production, will potentially direct single molecules, transform electric signals into magnetic ones, and provide high-resolution templates for transmission electron microscopes.

Composition and methods for controlling parasitic nematodes

Inventors: Ronald A. Rojeski, instructor of plant pathology; Jiarui Li, formerly of K-State; Timothy C. Todd, instructor of plant pathology; and Jrann Li, formerly of K-State.

Parasites want to get to soybeans, they’ll have to go through K-Staters first. Soybeans are the second largest crop in the U.S. and bring in about $37 billion each year. But nematode parasites plague soybeans with stunning, shocking, killing and higher susceptibility to other diseases, which cause annual losses of more than $1 billion. This new crop variety controls parasitic nematodes so soybeans can survive and go on to feed the world.

Several important human and animal viruses share a common thing — a specific type of virus protease. The 3C-like proteases of picornaviruses, caliciviruses and coronaviruses are important viral enzymes that regulate viral replication and viral protease inhibitors are therapeutic and/or prophylactic agents.

KSURF and KSU-IC: Turning discovery into commercial success

By Pat Melgares

Cheri Brandt knows that in the business world, the knowledge that is created in the laboratories and classrooms of Kansas State University has value.

Brandt, the president and chief executive officer of the Kansas State University Research Foundation, or KSURF, leads a team that makes sure researchers and faculty get credit for their discoveries.

“KSURF provides oversight to ensure faculty and university rights are protected,” Brandt said. “This includes inventions, software, copyrights, seed and plant variety, and proprietary materials.”

Brandt noted that the research foundation helps faculty members connect with resources and expertise to protect their intellectual property.

“We do this by assuring faculty with evaluating a discovery’s potential to be protected and generates commercial interest,” he said. “The research foundation also provides training through dedicated, material transfer and other agreements.”

Once intellectual property is protected, the Kansas State University Institute for Commercialization, known as KSU-IC, works with the research foundation to connect faculty with potential industry partners that have an interest in learning the protected intellectual property.

“New corporate relationships can often result in sponsored research opportunities, either to further the development of the marketed technology, or in completely new areas of interest to our industry partners,” he said.

KSURF and KSU-IC help spur marketing and economic development that can get the faculty member’s discovery more quickly into the channels where it benefits people.

“The research foundation believes K-State’s world-class research and discoveries should be shared with the wider possible audience through commercialization of new products and global solutions to benefit society,” Brandt said. “It’s our job to help faculty make strategic decisions to protect discoveries and give them the best chance to reach the marketplace.”

More information on how the Kansas State University Research Foundation and Kansas State University Institute for Commercialization help university faculty is available at k-state.edu/tech.transfer.

“KSURF provides oversight to ensure faculty and university rights are protected.” — Cheri Brandt

By Chris Brandt

The Kansas State University Research Foundation, or KSURF, helps faculty and university members connect with resources and expertise to protect their intellectual property.

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Cyber-physical systems

Eugene Vasserman, associate professor of computer science, explains, in under 100 words, what cyber-physical systems are and how Kansas State University computer scientists are ensuring they can be used to improve health care without compromising safety.

Cyber-physical systems — as small as light bulbs or as big as power plants — consist of components communicating over networks to coordinate how they sense and act on the physical world. Usually this involves much more software than found in typical physical objects. The Internet of Things is different, frequently used for human interfacing and control, while cyber-physical systems are also used for autonomous “closed-loop” control like self-driving cars. Securing cyber-physical systems is critical because component vulnerabilities may allow attackers to directly affect the physical world. In medical cyber-physical systems, patient safety is the main priority, and often depends on security.

Planted in history

“Women in Greenhouse” is a print made in 1995 from an undated negative in the Kansas State University archives. Although the exact date of this photo’s origin is not known, the university archivist and the director of K-State’s Historic Costume and Textile Museum date it to 1890-1900 based on clues in the photo. The first clue is the angle of the greenhouse roof, which matches that of the university’s original greenhouses used from 1883 to around 1910. The second clue comes from the clothing worn by the women pictured, especially the Mother Hubbard gown worn by the woman on the left. This American garment, with its loose style, was popular everyday apparel for women from around 1880-1920. The photo also illustrates how K-State has long been involved in plant research, including on sorghum as detailed in the story starting on Page 8.

Photo courtesy of the Kansas State University archives
Colors of health
In this photo of work by Annelise Nguyen, an associate professor of toxicology in Kansas State University’s College of Veterinary Medicine, immortalized cells, derived from normal human mammary tissue, were used to identify proteins of interest: early growth factor in green and mesenchymal biomarker in red. Nguyen has research interests in cancer biology and the role of gap junctions in intercellular communication. Read more about Nguyen’s latest research in the story starting on Page 24.